AD-758 184

STRIPPABLE COATING EVALUATION

William R. Drake

Air Force Packaging Evaluation Agency
Wright-Patterson Air Force Base, Ohio

February 1973

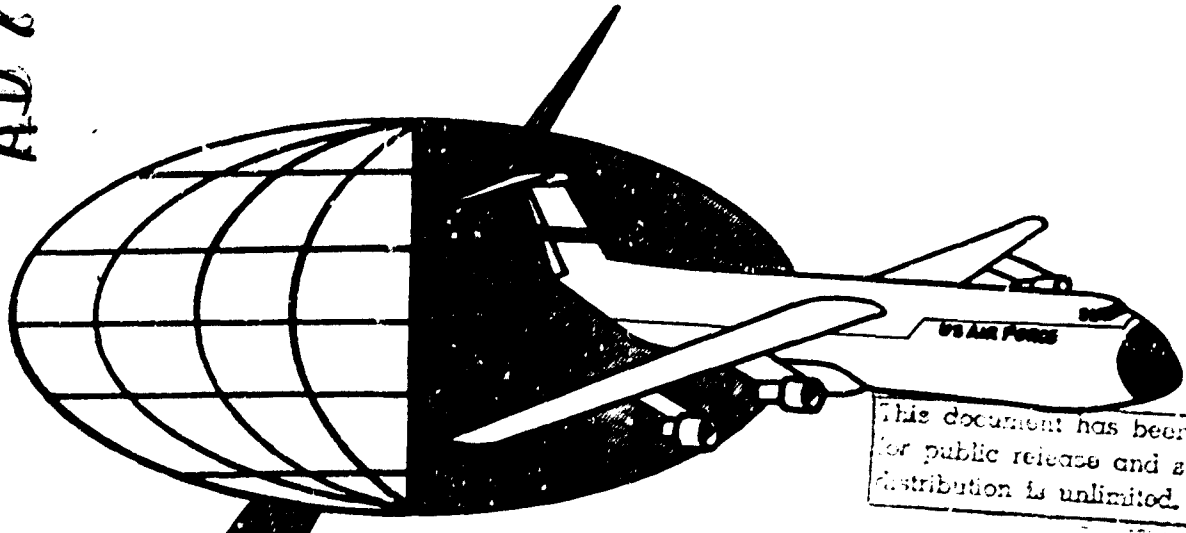
DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

AD758184

AIR FORCE PACKAGING EVALUATION AGENCY



This document has been approved for public release and sale; its distribution is unlimited.

AFPEA

HEADQUARTERS
AIR FORCE LOGISTICS COMMAND

DDC
RECEIVED
MAR 27 1973
C

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE

Best
Available
Copy

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Department of the Air Force
AFLC/DSP

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE
Strippable Coating Evaluation

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report - 24 Jan - 11 Feb 1972

5. AUTHOR(S) (First name, middle initial, last name)
WILLIAM R. DRAKE

6. REPORT DATE
February 1973

7a. TOTAL NO. OF PAGES
14

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.

b. PROJECT NO. 69-5-A-46

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
DSPS-73-2

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Approved for Public Release; Distribution Unlimited

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Air Force Packaging Evaluation Agency
AFLC/DSPS, Wright-Patterson AFB OH 45433

13. ABSTRACT

A series of tests intended to determine physical properties of a new MIL-C-6799 "type" of strippable coating were conducted. Although definitive conclusions cannot be drawn from the limited data generated to-date, a preliminary determination that the material does not possess adequate physical properties was made.

DD FORM 1 NOV 68 1473

UNCLASSIFIED
Security Classification

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

DSPS REPORT NO. 73-2
AFPEA PROJECT NO.
69-5-A-46

WILLIAM R. DRAKE
Chemical Engineer

AIR FORCE PACKAGING EVALUATION AGENCY

February 1973

DDC
RECEIVED
MAR 27 1973
C

This document has been approved

STRIPPABLE COATING EVALUATION

AFLC-WPAFB-MAR 73-85

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Strippable Coating						
Preservation						
Corrosion Protection						
Packaging						
Deterioration						
Water Vapor Transmission						

Table of Contents

N O T I C E

When Government drawings, specifications, or other data are used for any purpose other an in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation of conveying any right or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report is not to be used in whole or in part for advertising or sales promotion purposes.

INTRODUCTION:

The objective of this project was to determine selected physical properties of a new commercial sprayable, strippable coating that may be of value in the preservation of materiel. The coating properties were compared to the requirements of MIL-C-6799, "Coatings, Sprayable, Strippable, Protective, Water Emulsion."

BACKGROUND:

The storage procedures employed at the Military Aircraft Storage and Disposition Center (MASDC), Davis-Monthan AFB AZ, for the preservation of aircraft are being reviewed in hopes of standardizing Air Force, Navy, and Army requirements and improving the degree of protection offered. Preliminary meetings on a tri-service basis held in January 1972 indicated some concern for the long-term performance of MIL-C-6799 strippable coatings used for sealing aircraft openings and over-coating canopies and surfaces. As a result, the Air Force Packaging Evaluation Agency (AFPEA) in conjunction with the 4950th Test Wing/LGF was tasked with conducting preliminary studies on coating deterioration (reference AFPEA Report No. 72-1, AD740-895). As an adjunct to these preliminary studies, AFPEA evaluated a similar strippable coating, SHIELDEX, manufactured by W. R. Grave Company.

SHIELDEX is a proprietary two-component water based material and is similar to materials procured under MIL-C-6799. According to the manufacturer, SHIELDEX is applied in 0.005 to 0.010 inch film thickness by co-spraying the two components with either air or airless spray systems.

The SHIELDEX coating, examined by AFPEA, was still in the development or laboratory stage and may or may not be representative of coatings utlimately marketed under the SHIELDEX name.

DESCRIPTION OF TEST SPECIMENS:

Specimens 1 through 16 were SHIELDEX received from W. R. Grace and Company, Clarksville MD. The coating specimens were applied over glass panels by Grace. All specimens were received in March 1972.

Specimen 20 was a MIL-C-6799 coating (two coats) applied over an aluminum panel. The coating was applied in September 1970 at the Warner-Robins Air Materiel Area, Robins AFB GA, and maintained at AFPEA for over a year at 73°F and 50% R.H. Specimen 20 is reported only for comparison.

TEST EQUIPMENT:

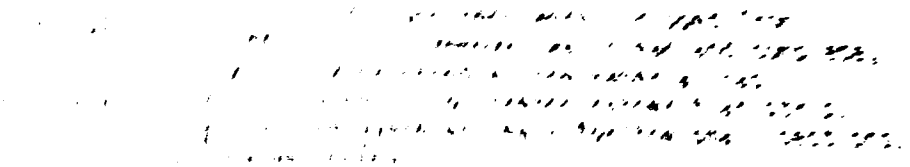
a. A Honeywell Water Vapor Transmission Rate Tester, Model W825A, was used to measure water vapor transmission rates (WVTR). Determinations were made at 100°F.

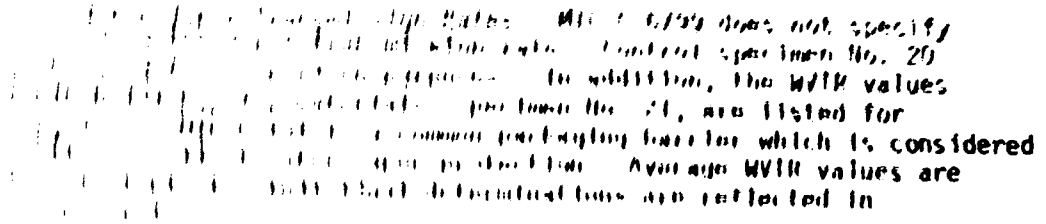
b. Tensile strength and elongation determinations were made on a Model TT-C Instron Testing Instrument. Tensile Load Cell D with a maximum full scale range of 1000 pounds was employed.

c. Thickness measurements and visual observations were made with a hand held magnifying viewer and an E. J. Cady dial reading automatic micrometer graduated in 0.001 of an inch.

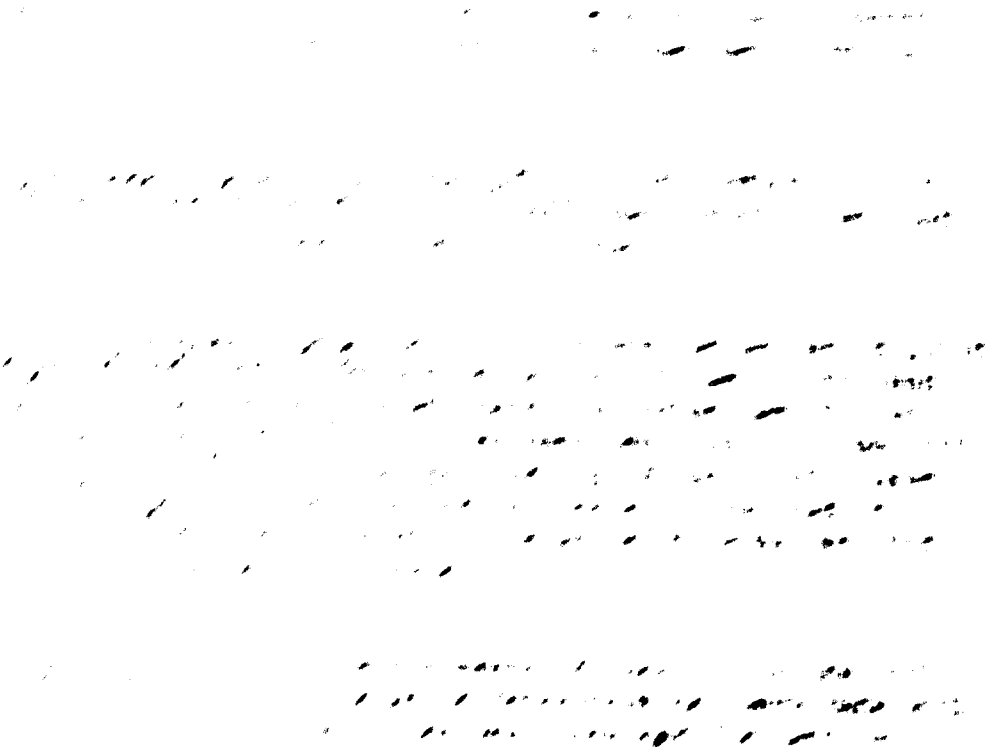
TEST PROCEDURES:

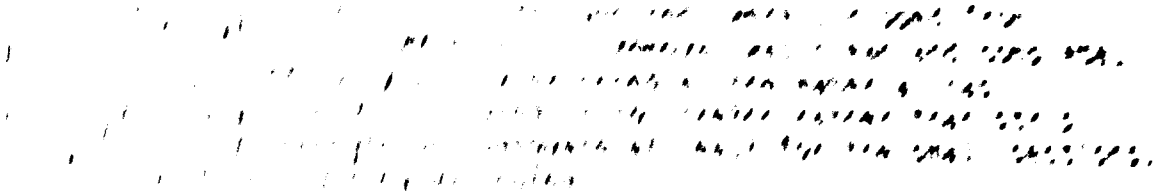
Environmental Conditions. Prior to the following tests, all specimens were conditioned at 73°F and 50% R.H. for 48 hours. All tests were conducted at these conditions in an environmentally controlled area. Where it was judged necessary, as between WVTR and tensile/elongation determinations, each specimen was allowed to condition at 75°F and 50% R.H. between tests. While this period of reconditioning varied from specimen to specimen, the minimum time for any one was 8 hours.

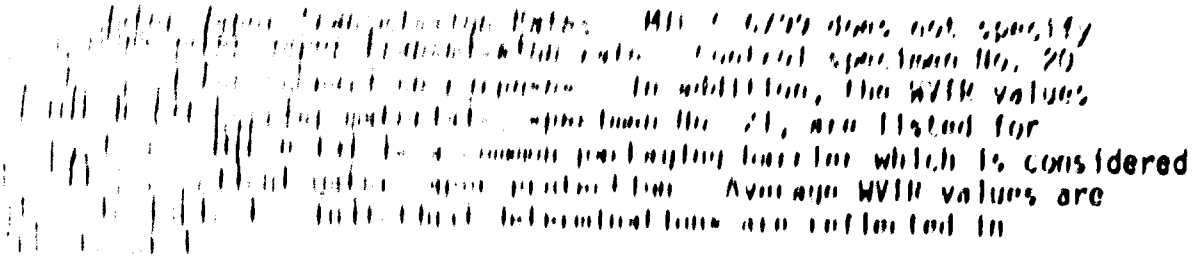




In addition, the WVTR values
are listed for
which is considered
Average WVTR values are







Best Available Copy

Table I. Water Vapor Transmission Rates

Specimen Number	$WVTR_2$ grams/100 in^2/24 hrs 100°F Exterior to Interior of Sample	Interior to Exterior of Sample
1	2.60	5.48
2	2.67	1.89
3	2.13	2.80
4	1.39	2.46
5	1.49	1.21
6	1.58	2.09
20	1.5	3.8
21	0.002	-

Tensile Strength-Elongation. Values of tensile strength and elongation are given in Table II. MIL-C-6799 requires a minimum tensile strength of 1700 psi and an elongation between 170-350% immediately after application and air drying for 24 hours followed by oven drying at 120°F for 24 hours and 4 hours conditioning at 73°F and 50% R.H.

Table II. Tensile Strength/Elongation

Specimen Number	Tensile Strength (psi)	Elongation (% of original length)
1	344	402
2	627	550
3	567	510
4	654	924
5	579	1040
6	681	837
7	1000	1082
8	1200	1091
9	846	1001
10	846	956
11	862	1000
12	524	880
13	513	876
14	457	860
15	588	920
16	511	924
20	388	168

Thickness. MIL-C-23760, "Coating, Sprayable, Strippable, Protective, For Preservation and Packaging of Weapon Systems and Components; Application of" recommends a total dry film thickness for MIL-C-6799 coating of approximately 0.012 inch. Average thickness values are given in Table III.

Table III. Thickness

Specimen No.	Thickness (inches)
1	0.016
2	0.015
3	0.012
4	0.013
5	0.019
6	0.016
7	0.014
8	0.012
9	0.013
10	0.013
11	0.013
12	0.021
13	0.016
14	0.021
15	0.017
16	0.018
20	0.027

DISCUSSION:

The tensile and elongation data presented in Table II shows a substantial variance from the requirements of MIL-C-6799. As previously mentioned, stripping of the material was hindered by high elongation. While on a small scale no problem was experienced, larger operations (e.g., aircraft sections) would, in our opinion, be difficult to strip. It is assumed that the material formulation could be modified to adjust the tensile/elongation values into a suitable range.

The water vapor transmission rates listed in Table I correlate fairly well with the control specimen (No. 20). Specimens 1, 3, 4,

and 6 exhibited the same higher rate in the interior to exterior direction as did the control. At this time, no logical explanation can be offered that would account for such a difference.

CONCLUSIONS/RECOMMENDATIONS:

The SHIELDEX coatings examined showed a marked difference in properties from the MIL-C-6799 specification requirements. They exhibited, on an average, only 40 percent of the specification tensile strength requirements and exceeded the maximum ultimate elongation value by 150 percent. Based solely on its physical properties, the material is not acceptable for Air Force use as a sprayable, strippable coating.

At this time, two recommendations are offered: (1) SHIELDEX should be modified to adjust tensile and elongation properties to specification values, and (2) the material should be subjected to the qualification tests of MIL-C-6799.

WATER VAPOR TRANSMISSION RATES

SPECIMEN NO. 1

Exterior to Interior		Interior to Exterior	
Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
43	2.67	25	5.23
45	2.56	22	5.22
46	2.50	21	5.48
44	2.61	21	5.48
43	2.67	21	5.48
44	2.61	20	5.75
Average	2.60	Average	5.48

SPECIMEN NO. 2

Exterior to Interior		Interior to Exterior	
Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
43	2.67	64	1.80
43	2.65	64	1.80
Average	2.67	63	1.83
		63	1.83
		62	1.85
		61	1.89
		59	1.95
		59	1.95
		58	1.98
		58	1.98
		Average	1.89

SPECIMEN NO. 3

Exterior to Interior		Interior to Exterior	
Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
65	1.77	41	2.80
62	1.86	41	2.80
57	2.02	41	2.80
54	2.13	41	2.80
50	2.30	Average	2.80
47	2.45		
40	2.88		
Average	2.13		

SPECIMEN NO. 5

Exterior to Interior		Interior to Exterior	
Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
93	1.24	49	2.35
88	1.31	48	2.40
78	1.48	48	2.40
73	1.48	45	2.56
Average	1.39	47	2.45
		48	2.40
		47	2.45
		45	2.56
		45	2.56
		46	2.50
		Average	2.46

SPECIMEN NO. 6

Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
106	1.09	96	1.20
93	1.24	97	1.19
77	1.50	95	1.21
70	1.65	94	1.22
69	1.67	94	1.22
61	1.89	Average	1.21
60	1.92		
Average	1.49		

SPECIMEN NO. 7

Seconds	g/100 in^2/24 hrs	Seconds	g/100 in^2/24 hrs
90	1.28	54	2.13
75	1.54	54	2.13
71	1.62	55	2.09
66	1.74	55	2.09
61	1.89	55	2.09
Average	1.58	Average	2.09

REPORT PREPARED BY:

WILLIAM R. DRAKE, Chemical Engineer
Materials Division, Directorate
of Packaging

REVIEWED BY:

MATTHEW A. VENETOS, Actg Chief
Materials Division, Directorate
of Packaging

APPROVED BY:

WALTER J. FELKER, Jr., Col, USAF
Director of Packaging
Office of DCS/Distribution